

HAND-HELD APPARATUS FOR INSTALLING FLASHOVER PROTECTION COVERS ON ENERGIZED ELECTRICAL CONDUCTORS AND EQUIPMENT

Related Application

This application is a continuation-in-part
of copending U.S. Patent Application Serial No.
09/415,828, filed on October 12, 1999, which is hereby
5 incorporated herein in its entirety by reference.

Field of the Invention

The present invention relates generally to
insulating covers and, more particularly, to devices
10 for installing insulating covers.

Background of the Invention

Electrical power may be transmitted from a
generation source to consumers via overhead conductors
15 strung between towers or poles. Electrical power is
conventionally transmitted in phases wherein multiple
conductors are utilized. One or more of these
conductors may be a "hot" conductor that carries a
specified amount of alternating current electric power.
20 Flashover may result if contact is made between two hot
conductors or between a hot conductor and ground. Non-

grounded contact with a hot conductor, such as when a bird sits upon a hot conductor, typically does not result in flashover.

5 The transmission of electrical power from a generation source to residential areas typically involves a combination of transmission devices which make up a transmission system. In a typical transmission system, power is generated by a power plant such as a hydroelectric installation, a steam
10 installation or a nuclear plant. The output from a power plant generator is normally about 25 kilovolts (kv). The output from a power plant generator is typically transmitted to a step-up substation where the voltage is increased to a transmission line voltage of
15 230 kv or higher. The next substation encountered is typically a transmission substation where the transmission voltage is decreased from the transmission line voltage to a sub-transmission voltage of approximately 69 kv. A distribution substation is then
20 typically used to step the voltage down from the transmission voltage to a distribution voltage of about 5 to 35 kv. The distribution voltage is the voltage that is transmitted to a residential area, either through overhead or underground distribution systems.
25 Single phase transformers are typically provided at the residential level to reduce voltage to a 240-120 volt, single phase, three wire residential power entrance.

Because uninsulated conductors are typically less expensive than insulated conductors, many electric
30 power suppliers utilize uninsulated conductors for the

transmission and distribution of electric power.

Although uninsulated conductors may be less expensive to install than insulated conductors, potentially costly problems may arise from the use of uninsulated conductors. Adequate clearances between conductors and/or other grounded objects may not be sustainable during adverse weather conditions (*i.e.*, storms and high winds). As a result, the potential for flashover caused by uninsulated conductors contacting each other or other objects may be increased. Another source of flashover may be caused by large birds and animals which have sufficient size to make contact with a hot conductor and a grounded object or another conductor. In addition, falling trees and tree branches may cause contact between hot conductors and ground which may result in flashover.

Substations typically include various steel structures for supporting power transmission and distribution equipment, such as circuit breakers, transformers, capacitors, regulators, hook switches and the like. Uninsulated conductors typically extend between the equipment in a substation in various directions and configurations. Because workers often work in close proximity to the equipment in a substation, it is typically desirable to cover at least some portions of the uninsulated conductors as well as grounded structures in the vicinity of uninsulated conductors.

Flashover may result in power outages which are undesirable to electric power suppliers and to

consumers. For existing power transmission and distribution systems, electric power suppliers may find it desirable to replace uninsulated conductors with insulated ones in order to reduce the likelihood of flashover. Unfortunately, the cost of replacing uninsulated conductors with insulated conductors may be expensive. Furthermore, an interruption in the delivery of power may be required to replace uninsulated conductors. This may be economically disadvantageous to an electric power supplier as well as being undesirable to electric power consumers.

Insulating covers for protecting workers from hot, uninsulated conductors, as well as for protecting against flashover, are available. These covers conventionally include thick rubber tubing, heat-shrinkable tape, and wrap-around covers. Unfortunately, there are drawbacks associated with installation methods for each of these types of covers. Thick rubber tubing can be somewhat bulky and difficult to install. Furthermore, tubing covers may require that a conductor be disconnected from service so that the conductor can be inserted through the tubing. Such electrical power service interruptions may be economically disadvantageous to an electric power supplier as well as being undesirable to electric power consumers.

The use of heat-shrinkable tape typically requires the use of a torch or other heat source for shrinking the tape to a conductor. The use of a torch or other heat source, particularly around substation equipment, is generally undesirable and can be labor

intensive. Wrap-around covers typically do not snap together and typically are secured to a conductor or other structure using ties. Unfortunately, this method can be a somewhat labor intensive process as well.

5 Insulating covers are available that do not require that a conductor be removed from service. These covers are typically flexible panels having elongated opposite edge portions that are configured to be joined together to enclose a conductor or other elongated
10 structure. Unfortunately, operations for joining the edges together on these types of covers can be labor intensive.

Summary of the Invention

15 It is, therefore, an object of the present invention to provide hand-held devices that allow a user to quickly join the edges of flashover protection covers together.

 It is another object of the present invention
20 to provide hand-held devices that allow a user to quickly install flashover protection covers on energized conductors without requiring that the conductors be removed from service during installation.

 These and other objects of the present
25 invention are provided by hand-held devices that can be used to quickly install flashover protection covers around energized electrical conductors and other equipment. A hand-held cover installation device according to the present invention includes a rigid
30 frame having opposite sides. A guide assembly is

secured to one side and a handle is secured to the other side of the rigid frame. The guide assembly includes an elongated bottom wall having opposite first and second ends. A pair of spaced-apart, elongated side walls extend upwardly from the bottom wall. The side walls converge towards the bottom wall first end to define a guide assembly outlet and diverge towards the bottom wall second end to define a guide assembly inlet.

The guide assembly includes a partition that aligns the various portions of a flexible panel passing through the guide assembly during installation of a cover. According to one embodiment of the present invention, the partition includes a base member that extends upwardly from the bottom wall between the elongated side walls. An elongated top wall is transversely connected to the base member so as to be maintained in spaced-apart relationship with the bottom wall. The guide assembly defines a pair of spaced-apart, converging passageways that are configured to slidably receive the elongated edge portions of a flexible panel therethrough. The converging passageways force together the opposite edge portions of a flexible panel being advanced through the guide assembly.

According to another embodiment of the present invention, a hand-held cover installation device includes a rigid frame having opposite sides and opposite edge portions, with a guide assembly secured to one side and a handle secured to the other side. The guide assembly includes an elongated bottom wall having opposite first and second ends. A first set of rollers is rotationally mounted to the frame first side in

spaced-apart relationship adjacent the elongated bottom wall first edge portion. A second set of rollers is rotationally mounted to the frame first side in spaced-apart relationship adjacent the elongated bottom wall second edge portion. The first and second sets of rollers converge towards the frame first end to define a guide assembly outlet, and diverge towards the frame second end to define a guide assembly inlet. The respective sets of rollers reduce frictional drag on a flexible panel being advanced through the apparatus.

The guide assembly includes a partition that aligns the various portions of a flexible panel passing through the guide assembly during installation of a cover. The partition includes a base member that extends upwardly from the bottom wall between the elongated side walls. An elongated top wall is transversely connected to the base member so as to be maintained in spaced-apart relationship with the bottom wall. The guide assembly defines a pair of spaced-apart, converging passageways that are configured to slidably receive the elongated edge portions of a flexible panel therethrough. The converging passageways force together the opposite edge portions of a flexible panel being advanced through the guide assembly.

According to another embodiment of the present invention, a hand-held cover installation device includes an elongated bottom wall having opposite first and second ends. A pair of spaced-apart, elongated side walls extend upwardly from the bottom wall. The elongated side walls converge towards the elongated bottom wall first end to define an outlet and diverge towards the elongated bottom wall second end

to define an inlet. The elongated walls have respective opposite facing undulating surfaces to reduce frictional drag on a flexible panel being advanced through the apparatus.

5 The apparatus includes a partition that aligns the various portions of a flexible panel passing through the apparatus during installation of a cover. The partition includes a base member that extends upwardly from the bottom wall between the elongated
10 side walls. An elongated top wall is transversely connected to the base member so as to be maintained in spaced-apart relationship with the bottom wall. The apparatus defines a pair of spaced-apart, converging passageways that are configured to slidably receive the
15 elongated edge portions of a flexible panel therethrough. The converging passageways force together the opposite edge portions of a flexible panel being advanced through the apparatus.

Hand-held devices according to the present
20 invention are particularly advantageous because they are lightweight and easy to use. With a single arm motion, the edge portions of a cover surrounding an energized conductor or other structure can be joined together. As such, flashover protection covers can be
25 installed on energized conductors and equipment safely and quickly.

Brief Description of the Drawings

30 **Fig. 1** is a perspective view of an exemplary flashover protection cover, in an uninstalled configuration.

Fig. 2 is a perspective view of the flashover protection cover of **Fig. 1** in an installed configuration surrounding an electrical conductor.

5 **Fig. 3** is a front perspective view of a hand-held device for installing flashover protection covers according to the present invention, wherein the guide assembly inlet is illustrated.

10 **Fig. 4** is a rear perspective view of the hand-held device of **Fig. 3** illustrating the guide assembly outlet.

Fig. 5 is an enlarged, front perspective view of the hand-held device of **Fig. 3** illustrating the guide assembly in greater detail.

15 **Fig. 6** is a front elevational view of the hand-held device of **Fig. 3** illustrating the flashover protection cover of **Fig. 1** being advanced through the guide assembly inlet.

Fig. 7 is a top plan view of the hand-held device of **Fig. 3**.

20 **Figs. 8 and 9** are rear perspective views of the hand-held device of **Fig. 3** illustrating the flashover protection cover of **Fig. 1** being advanced through the guide assembly.

25 **Fig. 10** is a perspective view of a hand-held device for installing flashover protection covers according to another embodiment of the present invention.

30 **Fig. 11** is a perspective view of the hand-held device of **Fig. 10** looking toward the guide assembly inlet.

Fig. 12 is a perspective view of the hand-held device of **Fig. 10** illustrating the flashover protection cover of **Fig. 1** being advanced therethrough.

Fig. 13 is a perspective view of a hand-held device for installing flashover protection covers according to another embodiment of the present invention.

Fig. 14 is a perspective view of the hand-held device of **Fig. 13** illustrating the flashover protection cover of **Fig. 1** being advanced therethrough.

Detailed Description of the Invention

The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout the discussion of the drawings.

Flashover Protection Covers

Referring now to **Figs. 1-2**, an exemplary flashover protection cover **10** for covering an energized conductor, or other structure, is illustrated in an uninstalled configuration (**Fig. 1**) and in an installed configuration (**Fig. 2**). The flashover protection cover **10** includes an elongated flexible panel **12** that defines a longitudinal direction (indicated by arrow **13**). The

flashover protection cover 10 has opposite first and second surfaces 12a, 12b, and generally parallel, opposite first and second edge portions 14a, 14b, as illustrated. The first and second edge portions 14a, 14b are configured to be joined together such that the first surface 12a forms a longitudinally extending chamber 16 (Fig. 2) configured to enclose an electrical conductor 20, or other structure, that extends along the longitudinal direction 13. The second surface 12b forms an outer surface of the flashover protection cover 10.

In the illustrated embodiment, edge portion 14b is configured to removably receive edge portion 14a therewithin. Edge portion 14a has an "arrowhead" configuration with shoulder portions 15 configured to be retained by elastic members 17 of edge portion 14b. The illustrated embodiment provides means for maintaining the panel edge portions 14a, 14b joined together under adverse conditions, while allowing the cover to be removed, if necessary, at a later time.

Still referring to Figs. 1-2, a wall or creepage extender 22 is connected to the panel inner surface 12a adjacent the first edge portion 14a, as illustrated. The creepage extender 22 is preferably configured to be longitudinally coextensive with the first chamber 16 when the panel edge portions 14a, 14b are joined together. The creepage extender 22 has a free edge portion 22b that is generally parallel with the first edge portion 14a, as illustrated. The creepage extender 22 is designed to retain any electrical flashover or arcing from the conductor 20 within the longitudinally extending chamber 16.

Flashover protection covers that may be installed via hand-held devices according to the present invention may have various shapes, sizes and configurations, and are not limited to the illustrated flashover protection cover of **Figs. 1** and **2**. Flashover protection covers are conventionally formed from polymeric materials of high dielectric strength, including, but not limited to, medium and high density polyethylene, and natural and synthetic rubber. However, flashover protection covers formed from virtually any type of material may be installed via hand-held devices according to the present invention.

Flashover Protection Cover Installation Apparatus

Referring now to **Figs. 3-9**, a hand-held apparatus **40** for installing a flashover protection cover **10** around an energized electrical conductor **20** (or other equipment or structure portion) according to an embodiment of the present invention, is illustrated. The hand-held apparatus **40** includes a rigid frame or plate **42** that has opposite first and second sides **42a**, **42b**. A guide assembly **44** is secured to the first side **42a** of the plate **42** and a handle **90** is secured to the second side **42b** of the plate **42**.

It is understood that hand-held devices according to the present invention are not limited to having the illustrated flat plate **42**. A rigid frame having virtually any shape and/or configuration may be utilized to secure the guide assembly **44** and handle **90** thereto, in accordance with the present invention. For example a rigid frame having an angled configuration may be utilized within the spirit and intent of the

present invention.

The illustrated guide assembly 44 includes an elongated bottom wall 46 having opposite first and second ends 46a, 46b. A pair of spaced-apart, elongated side walls 48a, 48b extend upwardly from the bottom wall 46, as illustrated. The elongated side walls 48a, 48b converge towards the elongated bottom wall first end 46a to define a guide assembly outlet 50 (Fig. 4). The elongated side walls 48a, 48b diverge towards the elongated bottom wall second end 46b to define a guide assembly inlet 52 (Fig. 4).

The illustrated guide assembly 44 also includes a partition 54, the function of which is to help align the various portions of a flexible panel 12 passing through the guide assembly 44 during installation of a cover. As will be described below, the illustrated partition 54 helps align the first and second edge portions 14a, 14b of a flexible panel 12 for engagement. In addition, the partition 54 helps prevent the creepage extender 22 from becoming entangled with the second edge portion 14b during cover installation. Preferably, the partition 54, the bottom wall 46 and the side walls 48a, 48b of the guide assembly 44 are formed from non-conductive materials having good machinability and wear resistance. Exemplary materials include, but are not limited to, DELRIN® brand materials and TEFLON® brand materials.

The partition 54 includes a base member 56 that extends upwardly from the bottom wall 46 between the elongated side walls 48a, 48b, as illustrated. An elongated top wall 58 is transversely connected to the base member 56 so as to be maintained in spaced-apart

relationship with the bottom wall 46. The top wall 58 and bottom wall 46 may be in parallel or non-parallel spaced-apart relationship. The top wall 58 includes opposite upper and lower surfaces 60, 62 and opposite elongated edges 64, 66.

As illustrated in the enlarged view of the hand-held apparatus in Fig. 5, the guide assembly 44 defines a pair of spaced-apart, converging passageways 70, 72 that are configured to slidably receive the flexible panel first and second edge portions 14a, 14b therethrough, respectively. A portion 62a of the top wall lower surface 62, a portion 46d of the bottom wall 46, and the side wall 48b define a first elongated passageway 70, as illustrated. A portion 62b of the top wall lower surface 62, a portion 46e of the bottom wall 46, and the side wall 48a define a second elongated passageway 72, as illustrated.

The top wall elongated edges 64, 66 are maintained in spaced-apart relationship with the respective converging side walls 48a, 48b to permit passage therebetween of a portion of a flexible panel. Preferably, each top wall elongated edge 64, 66 is in parallel spaced-apart relationship with a respective one of the converging side walls 48a, 48b, as illustrated in Fig. 7.

Accordingly, as illustrated in Fig. 6, the first elongated passageway 70 is configured to slidably receive the flexible panel first edge portion 14a therethrough. The second elongated passageway 72 is configured to slidably receive the flexible panel second edge portion 14b therethrough. Preferably, the top wall upper surface 60 is configured to slidably

receive the creepage extender **22** of the illustrated flexible panel **12** thereon. Thus, the guide assembly **44** is configured to join together the first and second edge portions **14a**, **14b** of the flexible panel **12** as the flexible panel **12** is advanced through the guide assembly **44** from the guide assembly inlet **52** to the guide assembly outlet **50**.

Figs. 8 and 9 illustrate a flexible panel **12** entering the guide assembly inlet **52** and exiting via the guide assembly outlet **50** as an assembled cover **10**. By grasping the handle **90** and moving the apparatus **40** along the longitudinal direction **13**, relative to the flexible panel **12** (as illustrated by arrow **92**), a user can quickly and easily engage the edge portions **14a**, **14b** thereof.

Referring back to **Fig. 5**, the illustrated bottom wall portion **46e** of the second elongated passageway **72** includes an elongated channel **47** formed therein. The channel **47** is provided to accommodate the thicker configuration of the flexible cover second edge portion **14b** relative to the first edge portion **14a** so that the second edge portion **14b** is properly aligned with the first edge portion **14a** as the first and second edge portions **14a**, **14b** are joined together. It is understood that a guide assembly according to the present invention may have various configurations and shapes to accommodate flexible panels having different shapes and configurations.

Still referring to **Fig. 5**, a pair of spaced-apart rollers **80**, **82** are rotationally mounted to the rigid plate **42**, via bolt **83** and nut **84**, downstream from the elongated guide assembly outlet **50**, as illustrated.

The rollers **80, 82** are configured to frictionally engage the cover **10** as it advances from the guide assembly outlet **50** and insure that the first and second edge portions **14a, 14b** are fully joined. The rollers **80, 82** make frictional contact with the cover **10** to help ensure that the ends **14a, 14b** of the flexible panel **12** are properly joined together as the cover **10** exits from the guide assembly outlet **50**. The rollers **80, 82** are not driven rollers (i.e., they are "free-wheeling").

Preferably, the rollers **80, 82** have a spaced-apart distance that is less than a spaced-apart distance of the converging side walls **48a, 48b** at the elongated guide assembly outlet **50**, as illustrated in **Fig. 7**. In **Fig. 7**, D_1 represents the distance between the converging side walls **48a, 48b** at the guide assembly outlet **50**, and D_2 represents the distance between the rollers **80, 82**. As illustrated, D_1 is greater than D_2 . In addition, the rollers **80, 82** preferably are formed from non-conductive, polymeric material, such as neoprene, that provides good frictional contact with the cover **10** exiting the guide assembly outlet **50**.

The illustrated handle **90** extends outwardly from the rigid plate second side **42b**. Handles having various shapes and configurations may be utilized. The present invention is not limited to the illustrated handle **90**. Preferably, the handle **90** is formed from non-conductive materials including, but not limited to, DELRIN® brand materials and TEFLON® brand materials. Preferably, the free end **90a** of the handle **90** is configured to be secured to a manipulator pole to

facilitate remote operation of the apparatus.

An exemplary manipulator device is referred to as a "hot stick" in the electrical power industry. Hot sticks are available from Hastings Fiber Glass Products, Inc., Hastings MI and A. B. Chance, Co., Centralia, MO.

Referring now to **Figs. 10-12**, a hand-held apparatus **140** for installing a flashover protection cover **10** around an energized electrical conductor (see **Fig. 2**), or other equipment or structure portion, according to another embodiment of the present invention, is illustrated. The illustrated hand-held apparatus **140** includes a rigid frame or plate **142** that has opposite first and second sides **142a**, **142b**. A guide assembly **144** is secured to the first side **142a** of the plate **142** and a handle **190** is secured to the second side **142b** of the plate **142**, as illustrated. The plate **142** also includes opposite first and second ends **143a**, **143b**.

The illustrated guide assembly **144** includes an elongated bottom wall **146** having opposite first and second ends **146a**, **146b** and opposite first and second edge portions **147a**, **147b**. A first set of rollers **148a** is rotationally mounted to the plate first side **142a** in spaced-apart relationship adjacent the elongated bottom wall first edge portion **147a**, as illustrated. Each of the rollers **148a** in the first set is configured to rotate about an axis (indicated by **A**) that is transverse to a plane defined by the plate first side **142a**. A second set of rollers **148b** is rotationally mounted to the plate first side **142a** in spaced-apart relationship adjacent the elongated bottom wall second

edge portion **147b**, as illustrated. Each of the rollers **148b** in the second set is configured to rotate about an axis (indicated by **A**) that is transverse to a plane defined by the plate first side **142a**. In the

5 illustrated embodiment the axis of rotation **A** of the first and second sets of rollers **148a**, **148b** is substantially normal to a plane defined by the plate first side **142a**.

The first and second sets of rollers **148a**,

10 **148b** converge towards the plate first end **143a** to define a guide assembly outlet **150**. The first and second sets of rollers **148a**, **148b** diverge towards the plate second end **143b** to define a guide assembly inlet **152**. The respective sets of rollers **148a**, **148b** reduce

15 frictional drag on a flexible panel **12** (**Fig. 12**) being advanced through the apparatus **140**.

The illustrated guide assembly **144** also includes a partition **154**, the function of which is to help align the various portions of a flexible panel **12**

20 (**Fig. 12**) passing through the guide assembly **144** during installation of a cover. The illustrated partition **154** helps align the first and second edge portions **14a**, **14b** of a flexible panel **12** for engagement. In addition, the partition **154** helps prevent a creepage extender **22**

25 (**Fig. 12**) from becoming entangled with the second edge portion **14b** during cover installation. Preferably, the the bottom wall **146** and the first and second sets of rollers **148a**, **148b** are formed from non-conductive materials having good machinability and wear

30 resistance. Exemplary materials include, but are not limited to, DELRIN® brand materials and TEFLON® brand materials. Preferably, the partition **154** is formed from

brass. However, it is understood that the partition 154 may be formed from various types of materials and is not limited to brass.

5 The partition 154 includes a base member 156 that extends upwardly from the bottom wall 146 between the bottom wall first and second edge portions 147a, 147b, as illustrated. An elongated top wall 158 is transversely connected to the base member 156 so as to be maintained in spaced-apart relationship with the
10 bottom wall 146. The top wall 158 and bottom wall 146 may be in parallel or non-parallel spaced-apart relationship. The top wall 158 includes opposite upper and lower surfaces 160, 162 and opposite elongated edges 164, 166.

15 As illustrated in Fig. 11, the guide assembly 144 defines a pair of spaced-apart, converging passageways 170, 172 that are configured to slidably receive the flexible panel first and second edge portions 14a, 14b (Fig. 12) therethrough, respectively.
20 A portion 162a of the top wall lower surface 162, a portion 146d of the bottom wall 146, and the second set of rollers 148b define the first elongated passageway 170, as illustrated. A portion 162b of the top wall lower surface 162, a portion 146e of the bottom wall
25 146, and the first set of rollers 148a define the second elongated passageway 172, as illustrated.

The top wall elongated edges 164, 166 are maintained in spaced-apart relationship with the respective converging first and second sets of rollers
30 148a, 148b to permit passage therebetween of a portion of a flexible panel 12 (Fig. 12).

As illustrated in Fig. 12, the first

elongated passageway 170 is configured to slidably receive the flexible panel first edge portion 14a therethrough. The second elongated passageway 172 is configured to slidably receive the flexible panel second edge portion 14b therethrough. Preferably, the top wall upper surface 160 (**Figs. 10, 11**) is configured to slidably receive a creepage extender 22 thereon. Thus, the illustrated guide assembly 144 is configured to join together the first and second edge portions 14a, 14b of a flexible panel 12 as the flexible panel 12 is advanced through the guide assembly 144 from the guide assembly inlet 152 to the guide assembly outlet 150. It is understood that the assembled cover 10 would surround a power line. However, for clarity, a power line is omitted from **Fig. 12**.

Referring now to **Figs. 13-14**, a hand-held apparatus 240 for installing a flashover protection cover 10 around an energized electrical conductor (see **Fig. 2**), or other equipment or structure portion, according to another embodiment of the present invention, is illustrated. The hand-held apparatus 240 includes an elongated bottom wall 246 having opposite first and second ends 246a, 246b.

A pair of spaced-apart, elongated side walls 248a, 248b extend upwardly from the bottom wall 246, as illustrated. The elongated side walls 248a, 248b converge towards the elongated bottom wall first end 246a to define an outlet 250. The elongated side walls 248a, 248b diverge towards the elongated bottom wall second end 246b to define an inlet 252. The elongated walls have respective opposite facing undulating surfaces 253a, 253b, as illustrated. The respective

undulating surfaces **253a**, **253b** reduce frictional drag on a flexible panel **12** (**Fig. 14**) being advanced through the apparatus **240**.

5 It is understood that surfaces having other configurations that present minimum points of contact with a flexible panel may be utilized in accordance with the present invention. For example, the elongated wall surfaces **253a**, **253b** may have a square wave configuration and/or a saw-tooth configuration. The
10 term "undulating" is intended to mean surfaces having a square wave configuration and surfaces having a saw-tooth configuration, in addition to the illustrated surface configuration of **Figs. 13-14**.

The illustrated apparatus **240** also includes a
15 partition **254**, the function of which is to help align the various portions of a flexible panel **12** passing through the apparatus **240** during installation of a cover. Like the other partitions described above, the illustrated partition **254** helps align the first and
20 second edge portions **14a**, **14b** of a flexible panel **12** for engagement. In addition, the partition **254** helps prevent a creepage extender **22** from becoming entangled with the second edge portion **14b** during cover
installation. Preferably, the bottom wall **246** and the
25 respective undulating surfaces **253a**, **253b** are formed from non-conductive materials having good machinability and wear resistance. Exemplary materials include, but are not limited to, DELRIN® brand materials and TEFLON®
brand materials. Preferably, the partition **254** is
30 formed from brass. However, it is understood that the partition **254** may be formed from various types of materials and is not limited to brass.

The partition **254** is similar to the partition described above with respect to **Figs. 10-12** and includes a base member (not shown) that extends upwardly from the bottom wall **246** between the
 5 respective undulating surfaces **253a**, **253b**. An elongated top wall **258** is transversely connected to the base member so as to be maintained in spaced-apart relationship with the bottom wall **246**. The top wall **258** and bottom wall **246** may be in parallel or non-parallel
 10 spaced-apart relationship. The top wall **258** includes opposite upper and lower surfaces **260**, **262** and opposite elongated edges **264**, **266**.

A portion of the top wall lower surface **262**, a portion of the bottom wall **246**, and the second wall undulating surface **253b** define a first elongated
 15 passageway **270**, as illustrated. A portion of the top wall lower surface **262**, a portion of the bottom wall **246**, and the second wall undulating surface **253a** define a second elongated passageway **272**, as illustrated. The
 20 top wall elongated edges **264**, **266** are maintained in spaced-apart relationship with the respective converging first and second walls **248a**, **248b** to permit passage therebetween of a portion of a flexible panel.

As illustrated in **Fig. 14**, the first
 25 elongated passageway **270** is configured to slidably receive the flexible panel first edge portion **14a** therethrough. The second elongated passageway **272** is configured to slidably receive the flexible panel second edge portion **14b** therethrough. Preferably, the
 30 top wall upper surface **260** (**Fig. 13**) is configured to slidably receive a creepage extender **22** thereon. Thus, the illustrated apparatus **240** is configured to join

together the first and second edge portions **14a**, **14b** of
a flexible panel **12** as the flexible panel **12** is
advanced through the apparatus **240** from the inlet **252**
to the outlet **250**. It is understood that the assembled
5 cover **10** would surround a power line. However, for
clarity, a power line is omitted from **Fig. 14**.

The foregoing is illustrative of the present
invention and is not to be construed as limiting
thereof. Although a few exemplary embodiments of this
10 invention have been described, those skilled in the art
will readily appreciate that many modifications are
possible in the exemplary embodiments without
materially departing from the novel teachings and
advantages of this invention. Accordingly, all such
15 modifications are intended to be included within the
scope of this invention as defined in the claims. In
the claims, means-plus-function clauses are intended to
cover the structures described herein as performing the
recited function and not only structural equivalents
20 but also equivalent structures. Therefore, it is to be
understood that the foregoing is illustrative of the
present invention and is not to be construed as limited
to the specific embodiments disclosed, and that
modifications to the disclosed embodiments, as well as
25 other embodiments, are intended to be included within
the scope of the appended claims. The invention is
defined by the following claims, with equivalents of
the claims to be included therein.